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Rubber Research Scheme (Ceylon)

Fourth Quarterly Circular for 1941.

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Office and Laboratories.—Dartonfield Estate, Agalawatta, Ceylon.

CONTENTS

ORIGINAL ARTICLES

ERRATUM

3rd Quarterly Circular for 1941.

Page 84, Table II, cage 6, line 1, should be corrected to read:—

Yield in lbs. per tree for period stated.	(163) G. 1	8.0	(59) TJ. 16	6.9

MEETINGS

NOTICES

DARTONFIELD ESTATE—VISITORS' DAYS

N.B.—Owing to reduced war-time staff there will only be one Visitors' Day at Dartonfield each month, namely, the *second Wednesday*. The services of technical officers will be available to visitors on that day ; the Estate Superintendent will be available every Wednesday. Visitors are requested to arrive on the estate not later than 9-30 a.m.

Visitors will be welcomed at the station on other days provided an appointment has been made in advance.

Dartonfield Estate is situated about 3½ miles from the main Matugama-Agalawatta Road, the turn-off being near culvert No. 14/10. The distance from Colombo is approximately 47 miles.

PUBLICATIONS

Rubber Research Scheme publications comprising Annual Reports, Quarterly Circulars and occasional Bulletins and Advisory Circulars are available without charge to the Proprietors (resident in Ceylon), Superintendents and Local Agents of Rubber estates in Ceylon over 10 acres in extent. Forms of application for registration may be obtained from the Director. Extra copies of publications can be supplied to the Superintendents of large estates for the use of their assistants.

ADVISORY CIRCULARS

The former issue of cyclo-styled Planting Memoranda have been replaced by printed Advisory Circulars. The undernoted Circulars may be obtained on application at 25 cents per copy. Future issues in the series will be sent free of charge to estates registered for the receipt of our publications :—

(1) Notes on budgrafting procedure.

(2) Programme of manuring for replanted Rubber clearings (October, 1941).

(3) Notes on Rubber seedling nurseries (November, 1939)

(4) Contour lining, holing and filling, cutting of platforms, trenches and drains (June, 1939).

(5) Straining box for latex (January, 1940).

(6) Notes on the care of budded trees of clone Tjirandji 1 with special reference to wind damage (September, 1938).

(7) Notes on procedure and equipment at Dartonfield Estate factory (May, 1940.)

(8) Planting and after-care of budded stumps (January, 1940).

(9) The preparation of latex for shipment (May, 1940.)

(10) Root disease in replanted areas (August, 1939).

(11) Emergency rubber coagulants (May, 1940).

(12) Warm air drying house for crepe rubber (May, 1940).

(13) Notes on the preparation of clean rubber (May, 1940).

(14) Rat Control (September, 1940).

(15) Cultivation of food crops in young Rubber areas. (December, 1941).

(16) Increasing the crops from Ceylon Rubber estates. (January, 1942).

WIND DAMAGE IN IMMATURE RUBBER.

C. E. FORD, *Geneticist.*

Introduction.

THE incidence of wind damage in immature Rubber during the South-West Monsoon storms of 1940 and 1941 caused a certain amount of concern. In order to obtain a reasonably reliable estimate of the degree of damage inflicted a questionnaire on the subject was prepared and circulated to estates through the Agency Houses during August, 1941. The questionnaire was comprehensive, the subject matter including kind of planting material, age, situation, state of growth, and type of damage. Records of damage in 1941 only were requested, this being considered a more representative year than 1940, when a storm of exceptional violence caused severe damage in localised areas. It is very satisfactory to note that 244 replies were received, representing well over three million trees, which is equivalent to between 80 and 90 per cent of Ceylon's total replanted area. The returns have now been analysed and the results are presented in this paper.

Grateful acknowledgment is made to all estates which sent in returns, for their co-operation.

Method of Analysis.

Owing to the large amount of work involved it was decided to confine attention for the present to the effect upon major wind damage of three factors only ; kind of planting material, age, and district, and to consider the influence of situation and state of growth at a later date.

Major wind damage was defined as trees uprooted plus trees with broken stems, and was measured by the number of such cases per thousand trees. Age was reckoned to the nearest year. Although immature Rubber was specified in the questionnaire, no

definition of maturity was given, and many records were received relating to areas up to twelve years old. All records, (with the few exceptions mentioned below) were included in the analysis, those relating to areas of 7 years and older being associated in a single age group. The few records excluded were those from areas less than 6 months old or in which there were less than 100 trees.

Presentation of Data.

The results of the analysis are set out in full in Tables I and II. In both tables the first set of entries represents the number of cases of serious damage per thousand trees, while the second and third sets give the total number of trees, and number of areas, respectively, from which the figures of the first set were derived. The entries "7+" in the age columns should be read as "7 and over."

Figures 1, 2, and 3 give a rough picture of the variations in amount of damage associated with differences in the three factors studied. The first two are constructed from the data relating to 3-year-old trees in Tables I and II, and the third is based upon the figures given in the column of Table I headed "All trees." These figures are meant to supplement the tables and not to replace them. A full appreciation of the significance of the data will only be obtained by careful study of the tables themselves.

The validity of the estimates of damage given in the tables is clearly dependent upon two factors :—

(a) The accuracy of the returns.

(b) The total number of trees and the number of areas upon which each estimate is based.

With reference to (a), though small inaccuracies are almost unavoidable in field returns of this nature, it is unlikely that they will be large enough to prejudice the value of the results. Proceeding to (b), it is apparent that with increasing total number of trees and number of areas, the estimates of damage become increasingly reliable. A few instances in which the estimates given in the table are obviously unreliable on this score are mentioned later in the text.

Before proceeding to a discussion of the results it is of interest to point out that the second set of entries in Table I provides an excellent indication of the changes in use of the different clones

and of clonal seedlings. It shows, for instance, that there has been a reduction in the use of TJ. 1, and particularly of B.D. 5, in the last 3 years, accompanied by a marked increase in the use of G. 1, P.B. 86, other clones, and clonal seedlings. This does not necessarily imply that the first named clones have lost favour, since many estates which planted up large areas of TJ. 1 and B.D. 5 in past years may have concentrated upon other material recently in order to obtain a more representative collection of good clones.

Discussion of Results.

Kind of Planting Material.—The relative amount of damage suffered by clones TJ. 1, TJ. 16, G. 1, and P.B. 86 is much as expected, though the figure for 5-year-old G. 1 is biassed by a single area in which damage was severe, and therefore probably overstates the clone's true susceptibility to damage at this age. The high incidence of damage in B.D. 5 is surprising. It appears to be of the same order as in TJ. 1, though in both clones the figure for 6-year-old trees is suspect on account of the relatively small number of areas from which records were received. The amount of damage to clonal seedlings is also unexpectedly high. The data indicate that between 14 and 15 trees in every thousand were seriously damaged. These figures obviously do not carry the same weight as the corresponding figures for all clones, or even for some individual clones, but nevertheless they clearly do not support the view that clonal seedlings as a class are less liable to wind damage than buddings. However, it should be emphasised that these particular figures are limited to 2 and 3 year old areas planted very largely with seedlings from two sources only (Prang Besar and Tjikadoe isolation gardens), and that if more extensive data were available a different picture might be obtained.

Age.—The data set out in the column of Table I headed "All trees" give the best estimate of the variation in incidence of damage with age. The least reliable figure is the highest, that for 6-year-old trees. This, however, does not affect the general conclusion that damage increases with age steadily to the fifth or sixth year, after which there appears to be a sharp decline, which may be associated with the closing of the canopy.

These data are illustrated in Figure 3.

District.—Table II shows quite clearly that damage was more severe in Kalutara District, and less severe in Kegalle District, than in the other Rubber Districts of the Island. It must be remembered, however, that the figures apply to a single year only, and while this may be satisfactory for the comparison of different forms of planting material (which are more or less equally distributed), it is not so satisfactory for the comparison of districts, since the distribution of storms may vary from year to year. In 1940, for example, the most serious damage occurred in the Kelani Valley and Ratnapura districts.

The figures in Table II do not show the same regular variation with age as those in Table I, and are probably insufficient for purposes of comparison of age groups between districts. The one outstandingly high figure for Kegalle district, seventh-plus year, is biassed by very severe damage on a single estate from which records of areas from 9 to 12 years old only were received.

Cumulative Total Amount of Damage.—It is of interest to form a rough estimate of the average total loss of trees per acre over a period of years. The data of the last column in Table I may be utilised for this purpose. As explained above, serious damage in this article includes trees uprooted and trees with broken trunks. Data from the questionnaire returns are available which show that the proportion of trees uprooted plus trees broken below 4 feet to trees broken above 4 feet is approximately 3 to 2. As a rough approximation all the trees of the first class and half the trees of the second class may be considered total losses, *i.e.*, 4 trees out of every 5. According to Table I, the average total serious damage over six years works out at 60 trees per thousand. Assuming an average of 125 trees per acre and a proportion of 4 trees lost out of 5 trees damaged, the total loss per acre over the first six years works out at 6 trees, or 1 per year of age. For areas over 6 years old similar working suggests a loss of the order of 1 tree every two years.

The above estimate is an average for all clones and all districts and hence should provide a fair measure of "normal" wind damage.

The figures may be regarded as reassuring as indicating that the expectation of loss from this cause is, in general, much lower than the margin allowed in the initial density of planting for

removal of trees by wind, disease, etc. Only in localised areas is it likely that the cumulative loss will be sufficiently serious to cause a reduction in stand below the optimum at maturity.

Kinds of Damage.—On the questionnaire forms, wind damage was classified under the following heads :—

Uprooted.
Stem broken below 4 feet.
Stem broken above 4 feet.
Roots loosened.
Stem split.
Branches broken.
Head bent over.

The first three types were classified as major damage and have been discussed above ; the remainder may be collectively distinguished as minor damage, though cases of split stem are often serious enough to justify inclusion with the forms of major damage.

The records of minor damage received were not so satisfactory as those of major damage. Partly on this account and partly in view of the considerable extra work entailed, they were not analysed statistically. A general inspection of the returns, however, shows that in a few areas cases of roots loosened and/or heads bent over were very frequent.

Recommendations for Treatment.

The methods employed to minimise damage or to treat cases once they have occurred are well known, though certain of them are still controversial. This, is an appropriate place in which to review them and to set out the Research Scheme's recommendations. It will be most convenient to consider the various types of damage in the order in which they are given above.

Uprooting.—The frequency of uprooting is increased by (a) poor or inadequate holing, and (b) planting in soil which does not afford a satisfactory anchorage to the tap root, *e.g.*, in "deniyas." The obvious corollary is that attention to these factors will minimise loss from this cause. In a few cases uprooted trees may be saved by re-erecting and supporting until a new anchorage is established, either by crossed supporting stakes or by coir guy

ropes. It may also be necessary to lighten the crown on one side. If lateral roots are broken it is advisable to saw off the crown and to treat the trunk as a very mature stumped budding.

Stem Breakage.—Trees broken above the level of the tapping panel in the first 3 or 4 years have a very good chance of recovery. The broken stem should be cut clean and tarred and should then be treated as a stumped budding. (At first allow 3 well spaced shoots to grow, and when all are firmly established, select the best one and remove the others. A single shoot is thus retained and allowed to develop a natural branching habit.)

Roots Loosened.—Swaying in the wind is the obvious cause of this form of damage. To avoid further loosening, affected trees should be staked, or preferably supported on three sides by coir guy ropes. With the first method there is grave risk of chafing, even though the tender young bark is insulated from the stake by a hessian binding. When coir guy ropes are used they should, where possible, be attached by loops above the first ring of branches, the stem at the point of attachment being well protected by a hessian binding, strips of old motor tyres, or other material. Even then it may be necessary to move the binding after two or three months in order to guard against ringing.

Stem Split.—This may be either an open split running down the trunk from a fork, (*i.e.,* a more extreme, but less complete form of the damage referred to below as branch stripping) or more rarely, a split closed both above and below. The writer has seen a few cases of the latter type successfully treated by binding tightly with coir rope or wire over a cloth padding until the cortical tissues healed.

Branch Breakage.—This includes both direct branch breakage and branch stripping, *i.e.,* those cases in which the branch tears away at its point of union with the main stem, taking a strip of bark from the main stem with it.

The only satisfactory method of controlling branch breakage so far developed applies (at present) specifically to clone TJ. 1. This method (which is described more completely in the Research Scheme's Advisory Circular No. 6) consists of removing the "master" branch in two or three stages, and allowing new growth to fill up the gap in the crown before proceeding from one

stage to the next. Not all the trees of this clone develop a master branch, but where one is formed it usually becomes evident during the second or third year.

The standard treatment for branch breakage is to saw all fractures clean and to tar all wounds and broken ends.

Head Bent Over.—Trees in which the head has been bent over without fracture of the stem can invariably be saved by re-erecting and supporting with coïr guy ropes. Damage of this kind usually occurs during a phase in the development of the tree in which the crown expands too rapidly relative to the strength of the stem.

General.—In the above notes the importance to be attached to a careful choice of planting material as a means of minimising wind damage has not been considered. Clones differ in their susceptibility to wind damage in three respects : (a) in the brittleness. or otherwise, of their wood, (b) in the weight of their crowns, (c) in the type of branch union. Of these, (a) affects stem and direct branch breakage, (b) by determining the amount of resistance a tree offers to the wind affects damage of all types, while (c) influences the frequency of cases of branch stripping. A specific inference from (b) is that clones with light heads should be selected for areas of loose soil.

The question whether lightening the crowns of heavy-headed clones by branch pruning in the third to fifth year reduces the amount of damage has attracted a certain amount of attention in this country recently *(cf.* the article entitled "Rubber Branch Pruning" by J. D. Farquharson in the Research Scheme's *Quarterly Circular* Parts 1 and 2 of 1941). The writer understands that such treatment is extensively used in the TJ. 1 areas of the East Coast of Sumatra. In this country, however, where wind damage is much less severe, the advantages which pruning may give in the reduction of damage must be carefully weighed against the effect upon growth and the time taken to reach tappable girth. It may be assumed that a large part of the advantage which many heavy headed clones have as regards vigour of growth and high yield is to be associated with the heavy foliage they carry, in which case it may be expected that reduction of branch and foliage by pruning will result in a lessening in the rate of girth increase. This point has not yet been proved experiment-

ally, and until more definite information has been obtained the Research Scheme is not in favour of extensive branch pruning (with the exception of the master branch of TJ. 1 mentioned above).

It has been suggested that over-manuring may be a cause of unbalance in the development of crown and trunk so that in a storm the latter is unable to bear the weight of the former and damage of one form or another results. The negative or small response to fertilisers in most field trials suggests, however, that this is seldom a factor of importance in Ceylon.

A further point arises from the fact that cases of wind damage are usually more frequent in the neighbourhood of gaps in the canopy. These gaps cannot be helped when they are created in the first place by wind loss, but might be avoided where they are caused by removal of trees during thinning operations. In addition to care in the selection of trees to be removed, two methods might be employed: (a) remove the branches (of the trees to be thinned out) in two or three stages, so producing small gaps only which will soon be filled by new growth, and (b) carry out thinning operations immediately after the South West Monsoon, so allowing the maximum time for a closed canopy to be reformed before the onset of the next storms.

Final mention may be made of the intelligent use of wind breaks as a means of reducing damage.

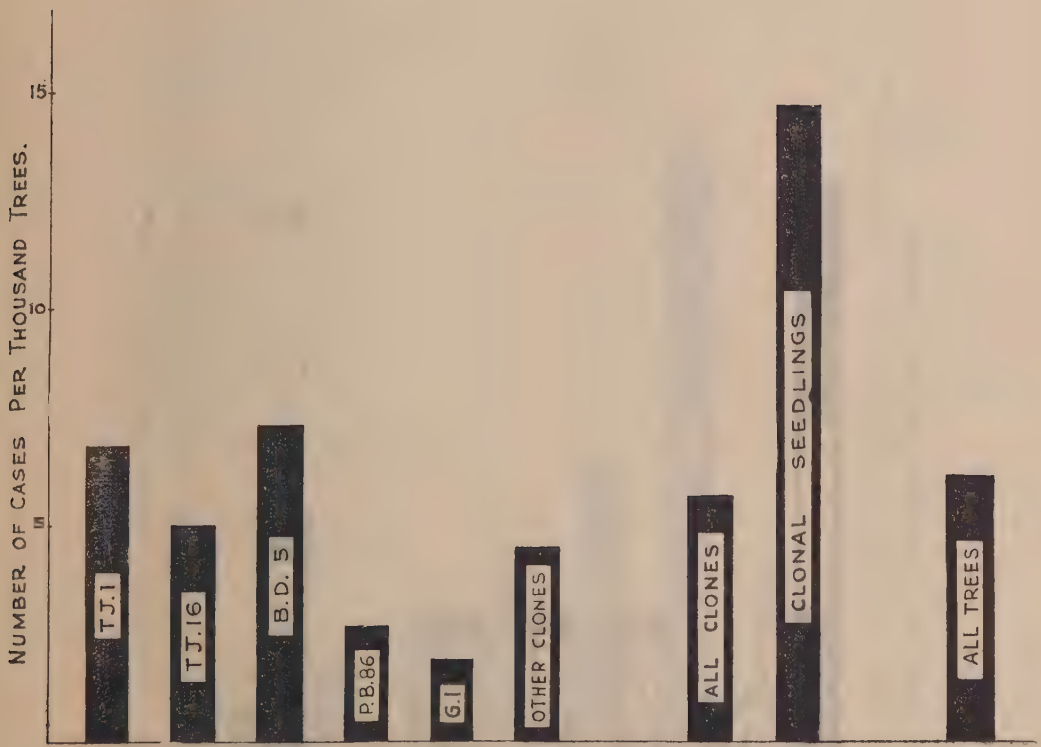


FIG. 1. MAJOR WIND DAMAGE TO 3 YEAR OLD TREES BY CLONES.

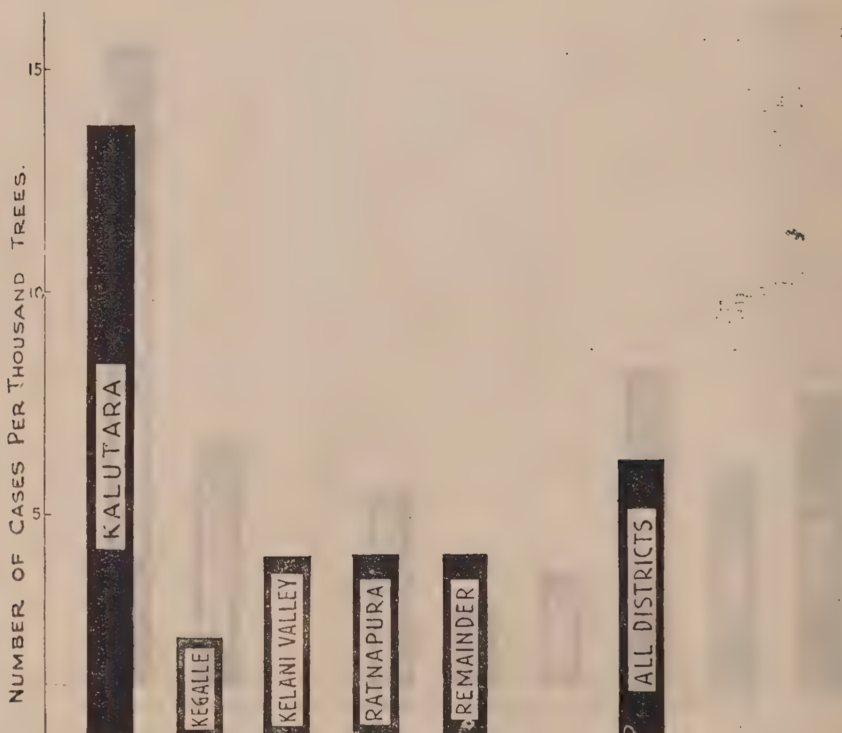


FIG. 2. MAJOR WIND DAMAGE TO 3 YEAR OLD TREES BY DISTRICTS.

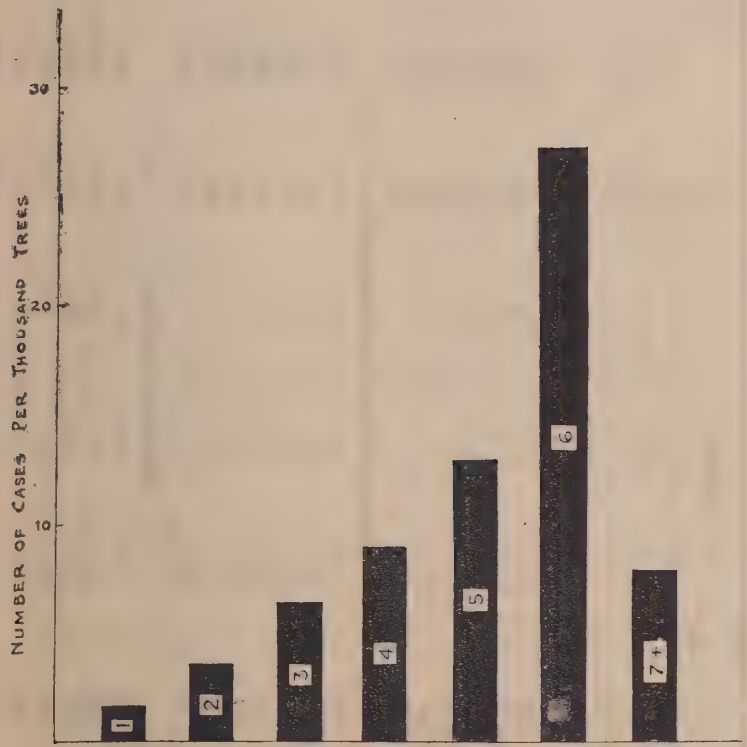


FIG. 3. MAJOR WIND DAMAGE BY YEARS OF AGE

TABLE I

ANALYSIS OF MAJOR WIND DAMAGE BY CLONES

Age in years	CLONE							Clonal seedlings	All trees
	TJ. 1	TJ. 16	B. D. 5	G. 1	P. B. 86	Other clones	All clones		
	Number of trees damaged per 1,000 trees								
1	3.6	2.9	6.0	0.2	0.4	1.2	1.9	0.1	1.7
2	4.3	2.4	4.2	1.3	1.8	2.3	3.1	14.5	3.5
3	6.7	4.0	7.3	1.9	2.7	4.5	5.8	14.9	6.3
4	11.2	5.1	10.2	0.9	2.7	3.2	8.9	5.6	8.9
5	13.9	13.1	14.2	7.4	—	6.8	12.7	6.6	12.7
6	36.1	16.6	33·3	—	—	5.0	27.2	7.3	26.9
7+	5.8	7.6	5.7	—	—	8.8	7.5	—	7.5
	Number of trees (in thousands)								
1	63	73	12	46	53	85	332	25	357
2	296	167	35	67	53	119	738	31	770
3	425	111	112	51	22	99	819	50	869
4	376	89	119	42	4	59	689	3	692
5	130	17	22	9	(1)	23	202	1	203
6	46	8	9	(1)	—	16	79	2	81
7+	50	8	22	(1)	—	94	174	—	174
	Number of areas								
1	28	36	10	20	31	35	160	12	172
2	72	70	22	34	26	54	278	13	291
3	107	52	50	28	16	55	308	23	331
4	100	36	54	27	8	35	260	3	263
5	45	6	17	7	(2)	15	92	1	93
6	10	3	7	(1)	—	8	29	1	30
7+	27	11	18	(2)	—	30	88	—	88

TABLE II

ANALYSIS OF MAJOR WIND DAMAGE BY DISTRICTS

Age in years	DISTRICT					All Districts
	Kalutara	Kegalle	Kelani Valley	Ratnapura	Remainder	
	Number of cases per 1000 trees					
1	0.2	1.0	0.3	0.3	4.7	1.7
2	5.3	1.6	1.7	5.0	4.0	3.5
3	13.9	2.3	4.1	4.2	4.2	6.3
4	17.3	2.4	3.5	10.8	3.5	8.9
5	22.5	2.4	11.0	4.1	8.1	12.7
6	37.9	—	25.5	5.8	1.8	26.9
7+	9.0	40.4	4.7	2.2	1.2	7.5
	Number of trees (in thousands)					
1	37	43	103	57	117	357
2	97	81	171	99	322	770
3	192	80	233	153	211	869
4	207	82	185	114	105	692
5	66	13	48	22	55	203
6	41	—	23	2	15	81
7+	39	19	3	32	81	174
	Number of areas					
1	27	32	35	23	55	172
2	44	34	73	29	111	291
3	86	33	90	29	93	331
4	87	36	47	33	60	263
5	33	7	21	4	28	93
6	13	—	7	2	8	30
7+	27	20	4	12	25	88

FIELD EXPERIMENTS ON DARTONFIELD ESTATE—XVI.

MEASUREMENTS OF GROWTH IN REPLANTED AREAS (1940.)

L. A. WHELAN, *Soil Chemist*

and

C. A. de SILVA, *Assistant Botanist.*

[This paper is the fifth in a series dealing with growth measurements in experimental areas of young Rubber on Dartonfield. Details of the scope and design of the experiments and annual progress reports will be found in the *Quarterly Circulars* for the period 1934-1940.]

No. 2 Replanting Experiment, 1938, 19½ Acres

THIS experiment contains 6 blocks and each block is divided into 9 randomised plots for a comparison of the manurial treatments N, P, K, NP, NK, PK, NPK, Compost and Control. Five blocks were replanted with budded stumps in May—June, 1938 and one in the following November.

The manures applied per plant to the N, P, K and Compost plots up to the last series of measurements in June, 1941 are given in Table I facing this page.

Girth measurements were made in June, 1941. A summary of the 1940 and 1941 measurements and of the increments for the 12 months is given in Table II facing this page.

The 1941 results are statistically significant at the 5 per cent level of probability (P=.05) which means that the odds are 19 to 1 against a difference of .90 inch or more between any 2 treatments being due to chance. Certain of the increment figures satisfy a more stringent test. Differences between treatments of .77 in. or more reach the 1 per cent level of probability (P=.01) which means that the odds are 99 to 1, but differences greater

than .56 and less than .77 are only regarded as reaching the 5 per cent level. Odds of 19 to 1 and 99 to 1 are commonly accepted in field experiments as satisfactory statistical evidence, and results

TABLE I

Manures Applied per Plant.

	Sulphate of Ammonia (N)	Saphos Phosphate (P)	Muriate of Potash (K)	Equivalent sieved Compost
May, 1938	5.2 oz.	3.3 oz.	1.9 oz.	10 lbs.
March, 1939	2.4 „	1.7 „	1.0 „	4 „
September, 1939	4.8 „	3.3 „	1.9 „	10 „
March, 1940	4.8 „	3.3 „	1.9 „	14½ „
September, 1940	9.1 „	6.4 „	3.8 „	17 „
	26.3 oz.	18.0 oz.	10.5 oz.	55½ lbs.*
Cost per 100 trees at 1939 prices (transport not included)	Rs. 10.35	Rs. 3.62	Rs. 4.10	Rs. 9.91

* Owing to the presence of approximately 25 per cent. stone and large fragments of woody material in the compost as received and which were not used in the experiment, the above figure of 55½ lbs compost used represents 74 lbs. compost purchased. Cost of the material was Rs. 3 per ton and transport charges Rs. 7 per ton.

TABLE II.

Mean Girth in Inches per Plant

Treatment	June, 1940	June, 1941	Increment 1940-1941
O	4.45	7.06	2.61
N	4.14	6.84	2.70
P	4.41	7.48	3.07
K	4.47	7.00	2.53
NP	4.47	7.90	3.43
NK	4.55	7.56	3.01
PK	4.64	8.08	3.44
NPK	4.80	7.84	3.04
Compost	4.68	8.17	3.49
Standard error	Not significant	.310	.198
Significant difference		.90 (odds of 19 to 1)	.57 (odds of 19 to 1) .77 (odds of 99 to 1)

complying with these odds are briefly described as "significant" and "highly significant" respectively.* It should not be overlooked that a response in growth or yield may be highly significant statistically but have little economic importance.

The 1941 results indicate a significant growth response to the PK and compost treatments, and the increment figures for the year a highly significant response to the NK, PK, and compost treatments.

The response to individual manures may be investigated further. A mean value can be obtained for all plants receiving a particular nutrient (approximately 480) and compared with that from the same number of plants not receiving the nutrient. For example, in the case of nitrogen, the plots N, NP, NK and NPK would be included in one group, and O, P, K and PK in the other, compost being omitted.

With the help of this factorial technique a greater replication is obtained and the results are also of wider application since each nutrient is examined in the presence and absence of the other two.

The following results are obtained on treatment of the figures in Table II (1941 measurements).

TABLE III

Mean Girth in Inches per Plant

	Without N	With N	Without P	With P	Without K	With K
	7.41	7.54	7.12	7.83	7.32	7.62
Increase over unmanured	.13		.71		.30	
Standard error				.141		
Significant difference				.41 (odds of 19 to 1)		
				.55 (odds of 99 to 1)		

The figures point to a highly significant response to phosphate ; a smaller and non-significant response to potash and a very small and non-significant response to nitrogen.

Experiments on commercial estates in different parts of the Island have given comparable results and in view of this it has been considered justifiable to modify our recommendations for the manuring of young Rubber to the extent that the use of phosphate

* The significance of the results has been expressed in the form of "odds" in accordance with the suggestion made by Mr. H. W. R. Bertrand in a recent letter to the Editor of "The Tropical Agriculturist" (Vol. 97, August, 1941, p. 110).

alone is now suggested for plants showing active growth and the NPK mixture is reserved for backward plants. (See Advisory Circular No. 2, 1941). It is clear from Table I that the adoption of this modification will result in a considerable reduction in the cost of manuring young Rubber.

No. 3 Replanting Experiment, 1936, 9½ Acres

The following treatments are compared :—

Methods of Opening	Methods of Planting	Manuring
1. Platforms	1. Budded stumps	1. Organic
2. Trenches	2. Stumped buddings	2. Inorganic (of equivalent NPK content).
3. Pitted drains	3. Seed-at-stake budded in the field.	

In June, 1941, girth measurements were made of all plants in the area and a summary is given in Table IV.

TABLE IV

Mean Girth per Plant in Inches

Budded stumps planted May, 1936. Stumped buddings planted May, 1936. Seed-at-stake planted August-September, 1936, budded in field December, 1937 to April, 1938.

	1939	1940	1941	Increment 1940-1941
Methods of Opening :				
1. Platforms	8.99	12.46	16.33	3.87
2. Trenches	8.87	12.17	15.81	3.64
3. Pitted drains	8.07	11.39	15.11	3.72
Standard error	.198			
				Not significant
Significant diff. (odds of 19 to 1)	.69			
Methods of Planting :				
1. Budded stumps	9.19	12.77	16.56	3.79
2. Stumped buddings	11.84	15.33	19.04	3.71
3. Field buddings	4.89	7.91	11.65	3.74
Standard error	.266	.273	.331	Not significant
Significant diff. (odds of 19 to 1)	.79	.81	.98	
Manuring :				
1. Organic	8.64	11.92	15.67	3.75
2. Inorganic	8.65	12.10	15.83	3.73
				Not significant

Methods of Opening

The early advantage of the platform and trench systems over the pitted drain system noted in earlier reports has been maintained but has shown little further increase, and the 1940 and 1941 results are not statistically significant. Poorer growth in the pitted drain plots in the first 2 or 3 years might have been due to the greater difficulty in isolating the young plants from the vigorously growing cover, and to the greater distance between the plant and the supply of water trapped by the earthworks. As the root system of the growing plant becomes capable of exploiting more ground this disadvantage would tend to disappear.

Root exposure has begun to show up to some extent on the bunds of the platforms and trenches. The movement of soil into the trenches has been slow and in order to bring the trench level to within 12 inches of the surface it has been found necessary to use soil from the bank behind the trench. This partial filling of the trenches is needed to encourage active growth and anchoring of the lateral roots.

Taking into account the additional cost of the trenches and platforms, the tendency to root exposure and the limited advantage in growth it would seem that on this area the more elaborate systems of opening have not been justified.

Methods of Planting

The girth of budded stumps is significantly greater than that of plants budded in the field and the girth of stumped buddings is significantly greater than that of budded stumps. The girth increments for the year are practically the same for the three classes of planting material. It was thought that at this stage of growth overshading by the stumped buddings and budded stumps might be exerting a retarding effect on the field buddings. No evidence of this could be seen from casual observation in the field and the records were, therefore, examined. From each of the 12 plots of field buddings two sets of 10 trees each were taken. One set comprising trees on the edges of the plots bordered by nursery buddings gave a mean girth of 11.24 inches whilst the other set comprising trees in the centres of the plots gave a value of 11.63 inches. This difference is small at present but may be expected

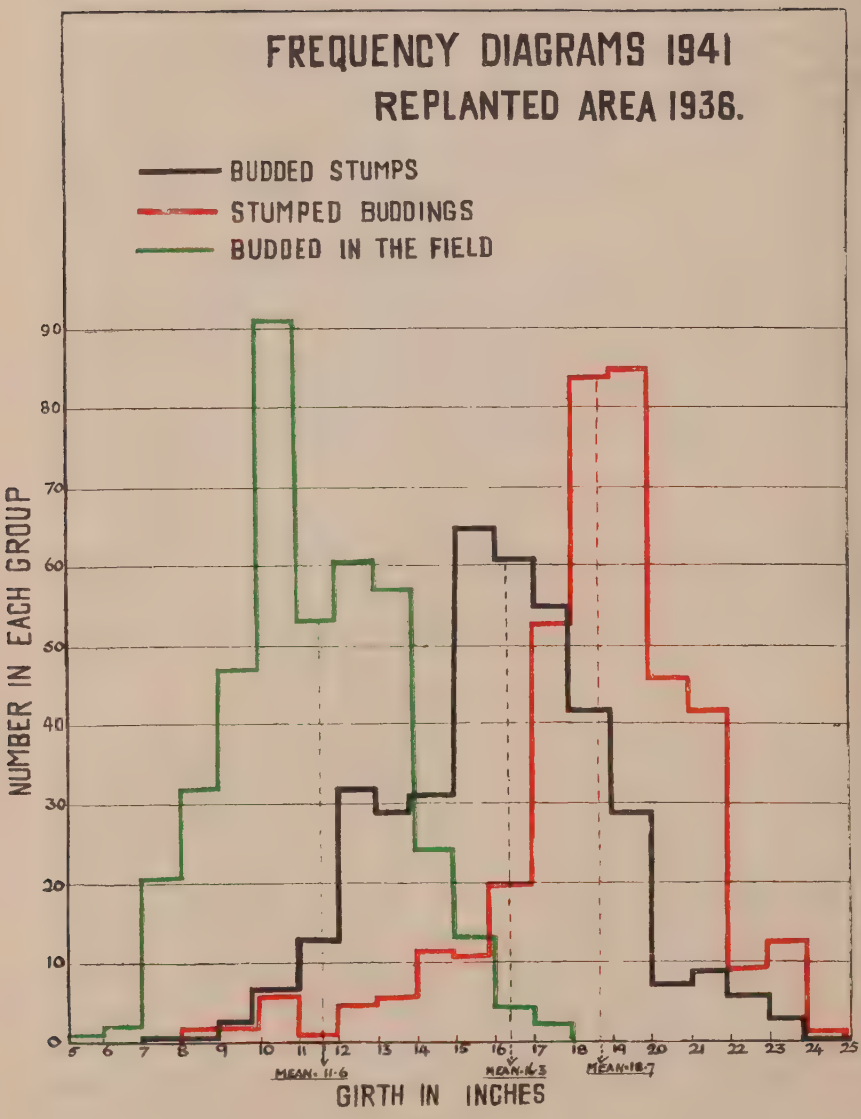

FREQUENCY DIAGRAMS 1941
REPLANTED AREA 1936.
BUDDED STUMPS
STUMPED BUDDINGS
BUDDED IN THE FIELD
NUMBER IN EACH GROUP
0
10
20
30
40
50
60
70
80
90
5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
MEAN- 11·6
MEAN-16·3
MEAN-18·7
GIRTH IN INCHES

Fig. 1

to increase as the trees get older, and this is therefore considered an opportune time to discuss the relative value of the three kinds of planting material.

The histograms for 1941 reproduced as Fig. 1 represent the frequency distribution, according to girth, of all trees in this area. Five years from planting in the field 70 per cent of the stumped buddings and 25 per cent of the budded stumps have reached a girth of 18 inches or over, whilst none of the plants budded in the field has reached that level.

Provided that replanting programmes can be planned well in advance and adequate nurseries laid down, the results of the experiment indicate that the time required for bringing young Rubber into bearing can be reduced to an important extent by the use of budded stumps or stumped buddings as planting material. This conclusion will not necessarily hold good for areas which differ substantially from Dartonfield in soil and climate, but it is believed that the trial area is fairly typical of Rubber land in the main planting districts.

Manuring

The difference between the girth of plants given an organic and those given an inorganic manure is slight and not significant. This is of considerable importance at the present time when changes have to be made in the composition of manure mixtures.

The manuring section of this experiment will now be discontinued since the absence of boundary trees would tend to make later results unreliable, due to the overlapping of feeding roots of trees on plot boundaries.

Summary.

(i). Replanting experiments are briefly described and the results are summarised.

(ii). Three-year-old budded stumps have shown a girth response to phosphate manuring of about three-quarters of an inch, a smaller and non-significant response to potash and no response to nitrogen.

(iii). On a general survey of the position to date it is concluded that the platform and trench systems of opening cannot be regarded as superior to the pitted drain system.

(iv). Plants budded in the field are still about 5 inches in girth behind plants budded in the nursery and planted out as dormant stumps.

(v). There is no difference in girth between young trees manured with an organic mixture and trees given an inorganic.

SELECTED NATURAL COVERS IN YOUNG BUDDED RUBBER.*

G. HUNTLEY, *Vincit Estate.*

Introduction

SOME 12 years ago a new planting fashion swept through the Rubber world when nature, at very short notice, was called in to repair the ravages of man by the so-called Forestry Method.

During 1935 I endeavoured, by introducing seeds and cuttings of selected trees, shrubs, and herbs, to transform some 50 acres of sun-baked, eroded soil carrying a stand of 78 trees, about 30 years old, to the acre, into the semblance of a forest floor.

In this essay I owe much to the kind and considerable help of Dr. J. C. Haig, of Peradeniya, who not only laid the foundations of the experiment by supplying me with a list of 19 tree-species, 12 shrubs, and 8 herbs suitable to it, but, subsequently, identified the majority of my local additions and classified them for me. I am most grateful to him for all the troubles he took on my behalf.

After 21 months the experiment was discontinued. Fashions change ! and, in any case, nature was too long a-stitching. Nevertheless the knowledge acquired stimulated and helped an obvious corollary, and, in this paper, an attempt is made to describe its principles and their application to Rejuvenation.

All figures have been personally collected and checked.

* The Rubber Research Board welcomes papers on subjects of general interest from outside contributors, but does not accept any responsibility for the views expressed therein.

Before leaving the old Rubber, however, a few notes may be of interest in illustrating the slow tempo of natural change on tired earth. Although, throughout, every attempt, even to the later addition of a small dose of sulphate of ammonia and Saphos, was made to foster the species, both introduced and uninvited, the close of the experiment produced a very minor register, thus :—

Class of Cover	No. of Species	No. of Plants	Average height 8 months from Planting	Height increase during subsequent 13 months
A	13	63	16 in.	7 in.
B & C	13	45	19 in.	2 ft. 11 in.

These measurements were taken at random over the entire 50 acres.

A specialised planting, over 2 acres in the same area, met with no greater success.

Class of Cover	No. of Species	No. of Plants	Height at Transplanting	Height increase during subsequent 18 months.
A	14	1000	6 in.—1 ft.	15 in.

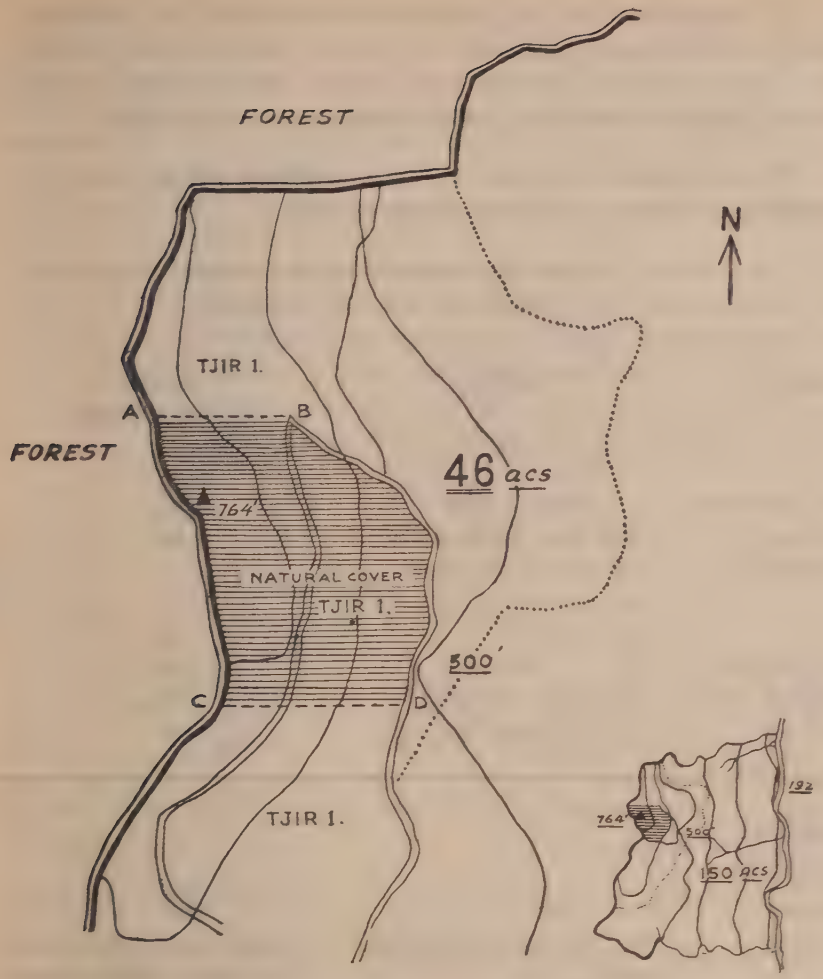
Under Rubber of similar age, (28 years), and spacing, (78 to the acre), but better soil conditions, the results are slightly improved.

Class of Cover	No. of Species	No. of Plants	Height one year from Planting	Height increase during subsequent 12 months
A	21	68	1 ft. 6 in.	1 ft.

The depth of root of above, ranging from 3 in. to 3 ft., gave an average of 10 in. over these 2 years, the following claiming particular attention :—

Kahata	3 ft. to 5 ft.
Puwakpeti	3 ft.
Thila	2 ft. 8 in.
Maha Undu Piyali	2 ft.

Time pulls well in nature's harness till man applies the goad.



PLAN OF EXPERIMENTAL AREA AT VINCIT

Part I.

The area of the experiment, detailed in the roughly contoured plan provided, is all old Tea land, planted in Rubber about 1906.

The 46 acres upper portion was felled in 1938 and that portion of it which provides the comparative figures was planted, in June of that year, with TJIR. stumps 18 months old and budded in the estate nurseries.

The soil is an average laterite, but develops a hard cabooky pan towards its northern end. The 5 acres which constitute the natural cover plot lie in the poorer section where the land is steepest, and, prior to felling, were sun-baked, fissured by erosion and barren of weed-growth ; conditions, in fact, inferior to the 50 acres of the elder trials.

The estate borders the intermediate Northern zone with an average rainfall, over the past 15 years, of 148.72 inches on 190 days. Three miles to the North, in a direct line, a similar period shows a decline of 18 inches and an increase of 31 dry days.

The N.E. season, October to May, registers about 3/5ths of this total on exactly half the number of days.

The contrast between the preparation of the field proper and the natural cover plot is tabulated for easy reference.

Details.	41 Acres	5 Acres Natural Cover
Last manured	1929—1930	do
Mixture	280 lbs. Synthetic Urea	do
Drainage	18 in. × 18 in. drains ; one pit 6 ft. × 3 ft. × 1½ ft. every 18 ft.	do
Last Cleared	1937	do
Creeping Cover	A little Pueraria	Nil
Terraces	Throughout but full	do
Replanting Operations		
Burning	Nil	Nil
Stacking	One line below platform earth.	2 lines—6 ft. above and 6 ft. below rubber plant.
Planting Method	June 1938, TJIR Contour 12 × 25 ft.	do (continuation of 41 acres contours.)
Earth work	A continuous platform, 5½ ft.—6 ft. broad including excavated earth. One silt-pit, (2 ft. × 1½ ft. × 8 ft.), every 12 ft.	Nil

Details	41 Acres	5 Acres Natural Cover
Creeping Cover introduced	Vigna 1940, A little Desmodium ovalifolium.	3 Desmodiums and "Pupula" only.
Upright Cover	Crot. usaramoensis, (died after 2 prunings). Teph. vogelli (unsuccessful).	Selected natural species only.
	Gliricidia 4 ft. apart at edge of platform : uprooted 1940 & 1941 & replanted 1940, 4 ft. apart in centre of inter-contour space highly successful	None of foregoing, but selected "A" class natural covers only. Planted in forked space of 13 ft. between stacked logs.
Manure Application	Recommendations of R.R.S. Twice a year, deep forked (1 ft.—1½ ft.) buried together with loppings of upright cover along the platform.	do Twice a year but broadcast **No** forking,* and loppings of natural cover spread but **not** trampled along the platform.
Care of Platforms	Clean weeded monthly	Cleaned of all growth, twice a year at pruning.

* Only the last two applications, on account of the inclusion of organics, have been lightly forked in.

As intimated above, the natural covers were planted, by seed, cutting and tuber, over the forked area between the double lines of stacking. This was carried out in June, 1938 in 4 sub-divisions, each with its base of all the creeping covers and the best species, the remainder being apportioned. Thus each sub-division contained about 24 different varieties in the 4 sections. From the outset excellent progress was made, less than a quarter of the number of species requiring supply.

It must be emphasised that all species are found locally. Much plant-life in the low-country appears to favour colonies and a somewhat parochial existence. Travel 5 miles in any direction from this estate and possibly one quarter of the varieties, probably more in shrub and herb, would be replaced by others equally as good.

Table I facing this page deals as fully as possible with the habit, propagation, and decay rate of all the plants under trial.

The details of propagation and decay were obtained as follows :—

Seeds were sown in boxes containing good soil and watered *daily*.

Cuttings were planted under mature Rubber at the same time and in the same place where leaf and stem were laid down to decay, the milieu being just below the 5 acres, where overhead shade was rather denser than average.

For the purpose of the latter trial the earth was forked before strawing.

The rainfall during the period of decay was :—

October	27.17 inches	over	24 days.
November	16.44 „	„	18 „

which practically covers leaf breakdown.

The 6 months during which most of the stems disintegrated registered as follows :—

4 months	56.22 inches	over	60 days
5 „	59.43 „	„	69 „
6 „	72.59 „	„	84 „

"decay"—total disappearance, or complete incorporation with the soil.

In all but two cases I have given the plant name in Sinhalese. It has been my experience that, in most villages, at least one man can be found who possesses considerable local plant lore.

Table II, of English equivalents, with the exception of 23 additions, is lifted bodily from Trimen, by the kind courtesy and permission of the Director of Agriculture.

Only the tongue is strange.

Decay of Leaf and Stem			Family	SPECIES		Local Name	Propagation		Ha
Stem	Leaf								
Months	Mature days	Immature days					Cuttings Days	Seeds Days	
				TREE					
	*		Leg.	Bauhinea Candida		—	C 22	16	
11	22		Euph.	Mallotus Albus		Bu Kendha	30		Per
	22		Apoc.	Tabernaemontana Dichotoma	M,	Divi Kadura	22		
			Leg.	Cassia Fistula	H.	Ehela	22		Dec
5½	20		Euph.	Ricinis Communis	M.	Enduru Tel	10		Per
	66		Cil.	Kurrimia Zeylanica		Eta Heraliya	C	39	
10	**15**		Urt.	Trema Orientalis		Gedumba	C		Per
	30		Leg.	Albizzia Odoratissima	H. M.	Hoori	C 22		Dec
5½	25	23	Mel.	Chickrassia Tabularis		Hulan Hik	20	26	
11	16		Verb.	Callicarpa Lanata	S.	Ihila	16		
	17		Myrt.	Careya Coccinea	H.	Kahata	37		Dec
	17		Euph.	Breynia Rhamanoides		Kailu	13	39	
11	22		Euph.	Aleurites Triloba	M.	Kekuna	37		Per
11			Euph.	Macaranga Tomentosa		Kendha	20	33	
	19		Mel.	Azadirachta Indica	M.	Kohomba			Dec
	*		Sap.	Scheichera Trifuga	H.	Kon	19		Dec
	29	13	Urt.	Ficus Hispida		Kota Thimbula	16		
	*		Combr.	Terminalia Glabra	H.	Kumbuk	23	26	Dec
	20	13	Leg.	Adenanthera Pavonina	M. N.	Maditiya	21	26	Dec
			Leg.	Pongamia Pinnata	M. N.	Magul Karanda	35		Dec
	*		Myrt.	Eugenia Jambolana	H.	Maha Dan			Dec
	*		Sap.	Bassia Longifolia	H.	Mi	24		Dec
	*		Verb.	Vitex Altissima	H.	Milla	13		Dec
5½	73		Lythr.	Lagerstromia Speciosa	H.	Muruta	20		Dec
5½	35	31	Verb.	Clerodendron Infortunatum		Pinna	13		Per
	60		Mag.	Michelia Champaca		Rata Hapu	17	23	
11	39		Urt.	Ficus Asperrima		Siurimidiya	23		
	29	15	Leg.	Tamarindus Indica	M.	Siyambala	37	31	Dec
	*		Til.	Eleocarpus Serratus		Veralu	C		
	112		An.	Michelia Champaca		Sapu or Hapu	20		Per
	11		Leg.	Peltophorum Ferrugineum	H.	Tya Vakai (T)			Dec
11	38		Leg.	Cassia Nodosa		—			Dec
				Palol					
				SHRUB					
5½	39	23	Acan.	Adhatoda Vasica	N. M. T.	Adhathodai	11		
	30	17	Rub.	Mussaenda Rondosa		Buthsarana	10		
2	19		Leg.	Cassia Hirsuta	M.		C	8	Per
	54—66		Leg.	Cassia Alata	X.	Et Thora	C 16	8	
11	28		Gesn.	Chirita Moonii		Gal Minnayri	20		Per
11	41		Verb.	Clerodendron Serratum		Keng Hendha	15	60	
4	42—63		Cod.	Croton Lacciferus	M. S.	Keppitiya	22	16	
5½	34		Leg.	Cajanus Indicus	H. M.	Rata Tora	C 10	6	
5½	35		Comp.	Tithonia Diversifolia	H. M.	Titta	4	7	Per
				HERB					
1	38	22	Leg.	Crotalaria Verrucosa	H.	Andana Hiriya			
½	33	30	Crass.	Bryophyllum Calycinum		Akkapana			Per
	25	17	Malv.	Veronicaefolia (Sida)	H.	Bevila	11		
2	22		Leg.	Cassia Lesschenaultiana		—		8	
2	15		Malv.	Sida Rhombhifolia		Et Bevila		26	Per
11	30	25	Malv.	Triumfetta Rhomboidea		Epola	22	9	Per.
2	25		Lab.	Hypttanthera Spec.		Gandha G. G.		7	An. o
3	10—15		Malv.	Sida Acuta 2	H.	Gas Bevila	C 12		Per
11	22		Rub.	Hedyotis Nodulosa	X H.	Geta Kola	24		
4	**28**		Malv.	Urena Lobata		Gon Epola			Per
	*		Scit.	Curcuma Zerumbet	X	Harankaha			
	23		Malv.	Urena Sinuata		Heen Epola	36	8	Per
11	10		Lab.	Ocimum Gratissimum		Hotala	10	25	Per
11	10		Til.	Triumfetta Bartramia		Kahi Epola	22		Per
11	19		Euph.	Acalypha Indica		Kuppamaynay			Per
½	16	10	Lab.	Ocimum Sanctum		Madura Tala	11	5	An.
5½	13		Leg.	Cassia Occidentalis		Peni Thora	10	8	An
	93		Leg.	Desmodium Triquelum		Puwakpiti	C 22	30	
	45		Verb.	Stachytarpheta Jamaicaenois		Pynayru'	11	39	An
7	44—68	25	Lab.	Leucaena Zeylanica		Thumba		10	An
7	**15**		Leg.	Cassia Tora 3		Tora	16	8	An
	41		Euph.	Phyllanthus Pulcher 4		Walang Asala	1		
4	38—45	25	Til.	Triumfettia Pilosa		Walbeth Anaga	25	8	Per
		36	Scit.	Zingiber Officinate		Wal Inguru			
	19		Leg.	Crotalaria Laburnifolia	H.	Yak Beriya		6	
			Leg.	Flemingia Strobilafera		Hampinna	C		
				CREEPER					
4	**20**		Leg.	Desmodium Heterocarpum	H.	Et Undu Piyali			Per
	14—22		Leg.	Desmodium Triflorum	M.	Heen U. P.			Per
4	22		Leg.	Desmodium Heterophyllum	H.	Maha U. P.			Per
1	35		Comp.	Vernonia Zeylancia		Pupula	35		Per

Figures in **black**
June 28th to October 18th

* Still undecayed at 112 days

1. Seeds in Rubber 45 days after planting
2. do 19 days
3. do 39 days
4. Flowers under Rubber in 60 days

FLOWERS		GENERAL NOTES
Colour	Season	
White	All year	Large bush. Gardens
	April/May	Tree 30′—40′ common
White, throat & tube yellow, very sweet scent	do	Small branched tree
Yellow	Jly/Aug.	Small med-sized tree, common in dry zone
		Waste, large shrub—village gardens
Green	Feb/Mar.	Large tree
Greenish	Feb.	Fast growing tree 25′—30′ waste & open places
White, sweet scented	May/Sept.	Large tree
Pale-green	May	Very large tree, tall, straight trunk
Pale-pinkish lilac	Mar/Sept.	Small bushy tree
		Moderately tall tree, chena and patna
Yellow	July	Small tree or bush
Greenish	October	Small tree
White sweet scent	Mar/May	Tall tree, straight trunk
Green	March	Large tree
Yellowish	Nov/Dec/Jly.	Shrub or small tree, swampy land
Greenish white-honey scented	Apr/May	Very large tree, thick trunk, streams & rivers
Greenish white	April	Tall tree
Greenish pink	do	Large tree, streams and rivers
White, honey scented	May, Aug.	Very large tree
Pale-yellow	Feb/May	do
Very pale violet or white	Jly/Oct.	do
Pink and Mauve	Apr/Jly.	Large tree, stream and river bank
White	Jly/Dec.	Shrub 3′—5′
Yellow, very fragrant	May	
Or. Yellow		Shrub or small tree
		Large tree
White	Jan/Jly/Aug.	Rather small tree
Pale sulphur yellow, sweet scented	Mar/Apr.	Largish tree
Dark yellow	May/Sept.	Very large tree, dry region.
Pink		Large tree
White with pink veins	December	Shrub 3′—6′ hedge and waste
Scarlet or yellow	All year	Waste shrub 3′—4′
Yellow		Large bush
Yellow		River stream & paddy land, large shrub 10′
Violet with white tube	June/Oct.	Large 2′—3′, rock & swampy places
Pale blue	June/Sept.	Shrub 4′—8′ roadsides
Greenish white	Aug/Nov.	Shrub 6′—10′ jungle fringe & gardens
Yellow	All year	Roadside and waste 10′—20′
Bluish purple	All year	Large herb 2′—3′ open ground
		Bare rocky places, Tamil gardens
Pale yellow	Jan/Mar.	Branches long prostrate, waste
Yellow		Erect 6′
Yellow	All year	Erect undershrub, waste and roadside
Yellow	Nov/Feb.	1½′—3′ waste
		Chena
Yellow	All year	Semi-shrubby erect branched, waste
White Or. yellowish	Sept/Apr.	Under shrub 3′—4′ wet places
Bright pink	Dec/Feb.	Large erect herb 2′—4′ waste
Pale yellow	Jan/March	1′—2′ damp shady places
Bright pink	Nov/Feb.	Herb 2′—4′ waste
Pale-greenish yellow	June/Sept.	Semi-shrubby 4′—6′ waste roadside & chena
		As Rhomb.
Green	All year	Herb 1′—2½′ waste and gardens
White	Aug/Oct.	Herb 1′—2′ waste and chena
Bright or yellow	June/Mar.	1′—3′ woody, waste
Bright violet and also yellow	September	Erect 2′—3′, waste, jungle fringe
Bright blue purple	All year	Roadside and waste, wet places
Pure white	Sept/Feb.	1′—2′ erect, waste and Tamil gardens
Pale Or. yellow	Jan/August	1′—2′ waste
Yellow	Jan/Feb.	Large erect, bushy places
Very pale yellow	June	5′—6′ scrub and jungle fringe
Bright pale-yellow keel tinged with purple	Feb/May	Large semi-shrubby herb 2′—4′
Purple also white	May/Sept/Nov.	Sub-erect woody, waste and chena
Bright purple	June/Oct.	Very small creeping, waste and chena
Pale purple		Prostrate herb, waste and chena
Pale violet	Sept/Oct.	Under-shrub waste and chena

M. Mentioned in Macmillan (Trop. Gard. & Planting)
H. Recommended by Dr. J. G. Haig
N. Used largely in Tamil gardens
S. Used largely in Sinhalese gardens
X. Straits A varieties

PERS. persistent
DEC. deciduous
PER. perennial
AN. annual

TABLE II

Sinhalese	English	Sinhalese	English
Alu	Ash	Kana	Edible
Amba	Mango	Katu	Thorny
Balu	Dog	Kiri	Milk
Bata	Reed	Kudu	Powder, Dust
Bin, Bim	Ground	Lunu	Salt
Bu	Wooly	Ma, Maha	Large
Dada	Ringworm	Mal	Flower
Dara	Angular	Mediya	Frog
Divi	Tiger	Mi	Honey
Diya	Water	Mian	Buffalo horn
Dodan	Orange	Mudu	Sea
Dunu	Bow	Mula, Mul	Root
Ela, Eli	Pale white	Nil	Blue, Green
Embul	Sour	Pala	Herbaceous
Et	Great	Panu	Worm, Insect
Eta	Seed	Pal	Leaf
Gal	Rock	Palla	Bark fibre
Gam, Gan	Village, Native	Peni	Sweet
Gan	River	Pini	Dew
Gas	Tree	Piti	Flour
Geta	Knot, Joint	Potu	Bark
Goda	Land, Dry	Rana	Golden
Gon	Bullock	Rata	Foreign
Gona	Sambhur	Ratu, Rat	Red
Hal	Rice	Sudu	White
Han, Ham	Skin	Suvanda	Fragrant
Hel	Lofty	Tel	Oil
Hin	Small	Titta	Bitter
Ho	Bad	Uru, Ura	Pig
Hulan	Wind	Wal	Wild
Ira, Iri	Striped	Walu	Clustered
Kaha	Yellow	Wana	Jungle
Kahata	Astringent	Wata	Round
Kalu	Black	Wel	Climber
Kara	Rough	Weli	Sand
Karal	Pod	Wila	Marsh
		Yakka, Yak	Wild, Devil

Looking up the hillside of this 5 acres today, with the rich natural cover just pruned, for the 5th time, the entire slope presents a fresh unbroken green, the strawn layers hidden except in the very steepest parts.

The Rubber, in bowl and height and canopy, is of the pattern and the levels of its neighbours on either side, at date, there is a noticeable saving in costs.

Of the 33 tree species originally planted only 6 are missing

Maha dan
Eta heraliya
Kohomba
Kon
Muruta
Rata hapu

Gal Minnayri, a semi-scandent, that loves rock and water, is the single shrub absentee, and, amongst the herbs, Geta Kola, Akkapana and Walbethanaga alone have disappeared.

Naturally the trees have not seeded, excepting the smaller type, Divikadura, Hulan hik, Kailu and Enduru Tel, but only the last named, as yet, has made seedlings.

All the herbs have reproduced themselves abundantly, and every shrub except Dhall and Keppetiya, which, albeit, have made plenty of fertile seed.

Of the entire 72 varieties, at date, 3 years and 5 months after planting, only four would be dictators.

Sunflower—which sprawls everywhere and roots at the nodes of its branches, underneath which there is very little undergrowth.

Pinna—with its close colonies of low growth tending to crowd out all competitors.

Kendha and Gedumba—very quick growing and spreading, overhead.

The last 3 are capable of producing trunks 10 in. to 15 in. in diameter after 3 years of growth.

Pynayru and Castor oil also, I fear, begin to usurp.

Otherwise there appears complete plant harmony.

Treatment is simple, but individual. Twice a year all mature stems are cut back, originally to 3 ft., (this was some 16 months

EXPERIMENTAL CLEARING BEFORE PRUNING

EXPERIMENTAL CLEARING AFTER PRUNING

after planting), and thereafter, 6 in. to 9 in. above this until the time is ripe for "arry vettu" or removal. This latter is effected by quintanny 6 in. or so below ground lovel ; an occasional plant is left as a seed-bearer.

Thinning, wherever necessary, and, of course, uprooting, especially of the species named, is carried out at every pruning, and also any necessary supplying.

From the 3rd lopping, walking along the rentices as each pruning becomes due, the wild plants present a continuous wall of jungle, all of A Class species, 18 feet broad and from 6 ft. to 13 ft. high on either side, through which the young tree bowls are invisible.

These 7 ft. rentices which form, of course, the contour planting lines, and are the continuation of the platforms, are cleared twice a year.

The fresh *un*-crushed litter on them is from 6 in. to 15 in. thick, which, if thoroughly trampled, reduces to 6 in. to 9 in.

In one month's time most of the leaves have disintegrated and the earth, with patches of brown sludge, shows clear under striations of brittle whitening sticks, which, 4 months hence, will themselves almost have vanished.

The soil texture is very visibly improving, and what little wash exists, from the steeper portion of the rentices, falls directly into the undergrowth which, immediately after each pruning, forms quite a satisfactory but *not*, as yet, an unbroken ground cover.

One factor is very apparent, even in the longest drought the 5 acres is green and unwithered.

The pictures of the clearing were made by Mr. C. A. de Silva of the R.R.S. and I am very grateful to him for his visit and all his trouble, and also to Mr. T. E. H. O'Brien for so kindly lending me his camera and his pages.

Individual drawings of most of the species grown can be made available if necessary.

This article would not be complete without references, other than general, to growth and costs.

The latter is self-explanatory.

Table of Costs

Of all items not common to both areas.

Ordinary

Details of Work.	Per acre 1938 Rs. cts.	1939 Rs. cts.	1940 Rs. cts.
Platforms	38.97	—	—
Green Manures	2.53	.35	—
Cover	.54	—	—
Forking	—	2.08	5.44
Burying	2.60	2.20	
Planting Gliricidia	—	4.34	1.32
Cost of do	—	2.25	—
Pruning do	—	.40	1.35
Do Crotalaria	.97	1.93	1.88
Control of Vigna	.87	.22	.17
Control of Centrosema	—	—	—
Supplying Gliricidia	—	—	—
Weeding	—	6.30	9.76
Cleaning Platform and Pit	—	2.18	1.95
Uprooting Crotalaria	—	—	.76
	46.48	22.25	22.63

Natural Covers

Details of Work	Per acre 1938 Rs. cts.	1939 Rs. cts.	1940 Rs. cts.
Double Stacking (1)	4.90	—	—
Collecting Seed	2.76	—	—
Forking	4.00	—	—,
¼ lb. Des. ovalifolium	.40	—	—
Pelt. Ferr.	.36	—	—
Collecting and planting 50 varieties :—			
July	9.00	—	—
August	1.51	—	—
October	3.85	—	—
Weeding	—	3.15 (2)	3.25
Application	1.00	2.00	2.00
Clearing rentices	—		3.81
Pruning	—	2.13	2.29
Stacking	—	—	—
Uprooting	—	—	—
Supplying	—	—	—
	27.78	7.28	11.35

(1) Two lines instead of one (2) Since June only.

Expenditure

1941

Ordinary		Per acre Rs. cts.	Natural Cover.		Per Acre. Rs. cts.
Forking	1st	5.03	Forking	1st	1.61
Burying	1st			2nd	2.80
Forking	2nd	5.11	Weeding		1.35
Burying	2nd		Application	1st	.38
Manuring	1st	1.28		2nd	.73
Do	2nd		Clearing rentices	1st	3.21
Pruning Gliricidia	1st	1.68		2nd	1.87
	2nd	2.07	Pruning & Stacking	1st	3.88
Pruning Crotalaria	1st	.65		2nd	4.89
	2nd	—	Uprooting	1st	.57
Weeding		4.05		2nd	1.25
Cleaning Platform & pit		4.97	Supplying	1st	.66
Uprooting Gliricidia	1st	—		2nd	—
	2nd	.56			
Cleaning Planting line	1st	—	Uprooting		
	2nd	.66	"Rambukkan"		2.03
		26.06			25.23

Grand Total for 4 Years

Ordinary ...	Rs.	117.42
Natural Covers ...	,,	71.64
In favour of Natural Covers	,,	45.78

The figures of growth are arrived at as follows :—

The platforms and their continuation in the natural cover area as rentices run, of course, at right angles to AB and CD in the plan.

8 of these in AB and 7 in CD, ranging, in both cases, from top to botton of the 5 acres, were taken.

In each platform and rentice 3 trees immediately inside the cover and 3 trees immediately outside were left as intermediates.

The measurements given are the averages of the 6 trees, in each platform and rentice, immediately succeeding these intermediates.

In other words they represent the average of 90 trees well within the cover and nearest to the clearing proper and 90 trees well within the clearing but nearest to the cover.

Each of the 2 lines of 6 trees is, therefore, 72 ft. long, and at their inner extremities they are 72 ft. apart.

The two sets of measures AB and CD illustrate clearly the deterioration of soil type earlier mentioned.

Table of Growth

Growth in inches and 1/16th in.

Platforms at	1941 at	Inside Natural Cover	Outside Natural Cover	In Favour of Natural Cover	Accepeted Method
A B	May 20th	5 8/16	5 3/16	5/16	
	Nov. 20th	8 10/16	8 7/16	3/16	
	Increase	3 2/16	3 4/16		2/16
C D	May 20th	5 11/16	5 9/16	2/16	
	Nov. 20th	8 15/16	8 15/16		
	Increase	3 4/16	3 6/16		2/16
Average	May 20th	5 9/16	5 6/16	3/16	
	Nov. 20th	8 12/16	8 11/16	1/16	
	Increase	3 3/16	3 5/16		2/16

Part II

Time only will complete. It has been suggested that, 3 years hence, the tables of plant maintenance and plant harmony they provide will form a fitting conclusion to this article.

General.

The experience of 3½ years amply proves that the care of natural species is no haphazard quantity or general routine work. To become axiomatic the system must finally show definite growth superiority in the main crop and definite saving in capital.

It entails much personal labour, for even in the tiniest forest corner, the telescopic eye is largely blind.

Note by Director, R. R. S.

Mr. Huntley is to be congratulated on his account of a very interesting experiment, the early results of which suggest that the cultivation of a mixed cover of selected indigenous plants in replanted areas may prove of great value in reconditioning the "sun-baked eroded soils" which are only too common in Ceylon and elsewhere. The article is very timely in view of the promising reports of growth in new clearings opened on the "no-burn" system, and the accumulating evidence of the tendency for creeping leguminous covers to deteriorate after a few years.

I have seen the experimental area and consider that the type and density of cover compares favourably with the mixed cover in a "no-burn" clearing at Nivitigalakele and similar clearings seen in Malaya.—T. E. H. O'B.

SUGGESTIONS FOR THE TAKING OF A CENSUS IN REPLANTED OR NEW PLANTED AREAS*

E. W. WHITELAW, *Pantiya Estate.*

THE taking of a correct count of young trees in a replanted area is not so easy a matter as first appears; especially where planting has been on the contour system. In this case small broken contours and single trees soon lead to confusion, which it is impossible to rectify without starting all over again, and it is safe to say that it is impossible to obtain an absolutely correct census by merely counting. The work is much easier where trees are planted in straight lines, but even here it is an arduous task to work from tree to tree, through a dense mass of leguminous growth, and keep throughout an exact tally of the number of the trees.

It is probable that very few of the census records in Ceylon today are accurate, although nearly all Planters conscientiously believe them to be so. To prove this contention any Planter should take the count of, say, a well defined 10-acre contour-planted block, and then instruct several Conductors or K.P.'s to independently take similar counts. It is very unlikely that any two figures will agree.

As an example, the case of a small one-acre patch replanted with large 3-year-old stumped buddings, each and every one of which was easily discernible from the supervision road, is quoted.

The various counts came to :—143, 147, 149, 157, 158 trees, respectively.

The correct number was 149 !

If there can be a mistake of 10 in an easily counted block of one acre, what can the total error amount to over say 300 acres of difficult land ? It might easily be up to 2,000.

* The Rubber Research Board welcomes papers on subjects of general interest from outside contributors, but does not accept any responsibility for the views expressed therein.

A correct census is essential on every estate. In the first place to satisfy the Management that the requisite stand per acre has been established, and secondly for the purpose of returns to the Rubber Controller. Assessment is granted at a rate per tree. A mistake of 10 trees per acre might easily result in, at 4 lbs. per tree, a loss in assessment of 40 lbs. per acre or alternatively the estate may be unconsciously guilty of submitting faulty returns to the Controller.

A simple and almost foolproof method for the taking of a correct census has been devised and it eliminates the human error to an almost negligible degree. Perforated tickets, about 3 ins. square, and of bright colour are printed in long rolls of 2,500 and serially numbered 1 to 2,500. An intelligent K. P. accompanied by two podians proceeds from tree to tree. The podians paint a patch of latex at about 5 ft. high and the K. P. tears off the next ticket number and sticks it firmly to the tree. The numbers should face the nearest supervision road, or other point of vantage, from where the Superintendent or the Conductor can satisfy himself, from a distance, that there is a coloured ticket adhering to every tree. The work *must* be done on a day when rain will not wash off the tickets.

As each block or field is dealt with it is only necessary to record the next, serial number on the roll of remaining tickets to know the exact number of plants in that area.

[This system is not suitable for clearings under 6 months old, as till then the plants are too small.]

The cost, considering that a correct count is obtained, is negligible.

One man and two podians will cost Rs. 1-50 per day and can do about 10 acres a day. 50 acres would therefore cost about Rs. 7-50 in labour.

7,000 tickets will cost about ... Rs. 12-00
Total, say Rs. 20, or -/40 cents per acre.

The tickets, with instructions for use, can be obtained in rolls of 2,500 tickets each at Rs. 4 per roll (Postage 35 cts. per roll extra) from The Sathminikirula Printing Works, 2, Goods-shed Rd., Kalutara South.

Note.—It is recommended that *all* trees, whether poor or good be included in the first census, which can be regarded as the basic census, from which afterwards can be deducted removals for poor growth, wind damage etc., etc.

PLANTING NOTE

REMOVAL OF UNPRODUCTIVE TREES

Arising from a discussion at a meeting of the Rubber Research Board the Rubber Controller was asked whether the removal of unproductive trees from a mature area would lead to a reduction in the standard production of the area. He has kindly agreed to the following informal ruling being placed on record :—

"The Standard Production of an estate or smallholding is varied under Section 26 (1) (c) (of the Rubber Control Ordinance No. 63 of 1938) only if a fair proportion of the Rubber trees which were taken into account for the purpose of the determination of the assessment of the Standard Production have been felled or destroyed, and no variation is made on account of the removal of unproductive trees, as such unproductive trees would not have been taken into account in determining the Standard Production."

The above ruling is only of academic interest at the present time with the export quota standing at 120 per cent, but it may prove of practical value at a later date.

T. E. H. O'B.

MEETINGS

RUBBER RESEARCH SCHEME (CEYLON)

Minutes of the fifty-eighth meeting of the Rubber Research Board held at the Chamber of Commerce, Colombo, at 2-30 p.m. on Monday, 27th October, 1941.

Present.—Mr. E. Rodrigo (in the chair), Mr. C. E. Jones (Deputy Financial Secretary), Mr. T. Amarasuriya, Mr. W. P. H. Dias, J.P., Mr. G. E. de Silva, M.S.C., Mr. T. C. A. de Soysa, Mr. J. D. Farquharson, Mr. L. P. Gapp, Mr. F. H. Griffith, M.S.C., Mr. R. J. Hartley, Mr. R. C. Kannangara, M.S.C., Mr. F. A. Obeyesekere, Mr. N. D. S. Silva, O.B.E., J.P., and Mr. E. W. Whitelaw.

Mr. T. E. H. O'Brien, Director, was present by invitation.

Apologies for absence were received from Messrs. J. A. S. Agar, L. M. M. Dias and Mr. E. C. Villiers, M.S.C.

1. Minutes

(a) Draft minutes of the meeting held on 21st July, 1941. which had been circulated to members, were confirmed and signed by the Chairman.

(b) Matters arising from the Minutes :—

1. *Supplies of sulphur.*—Reported that adequate supplies of Java sulphur are expected in Ceylon before the next refoliation season.

2. *Conference of Directors.*—Reported that the proposed Conference had been postponed until April, 1942.

3. *Advisory Services to Estate Owners in South India.*—Reported that the United Planters' Association of South India had proposed terms on which advice by correspondence might be made available to estates in South India. It was decided to accept the proposed terms.

2. Decision by Circulation of Papers

Lease of Crown Land for Experimental Planting.—Reported that the Visiting Agent's recommendations had been adopted by the Experimental Committee, and that application had been made for the lease of a block of Crown land at Hedigalla.

3 Director's Report for 2nd Quarter 1941

Wind Damage.—Reported that a large number of replies to the questionnaire regarding wind damage in young areas had been received, and that the information was being tabulated for publication in the *Quarterly Circular.*

Manuring Young Rubber.—The Director explained the modified recommendations for manuring young Rubber which it was proposed to embody in a revised edition of Advisory Circular No. 2. After discussion it was agreed that the recommendations should be modified as suggested.

The report was then adopted.

4. Research Programmes for 1942

Research Programmes for 1942 were considered, and it was noted that the progress of work would depend on the availability of staff due to the international situation. The programmes were adopted.

5. Experimental Committee

Recommendations made at a meeting held on 29th September 1941 :—

(a) Estate Estimates for 1942.—Detailed estate estimates for 1942, as recommended by the Experimental Committee, were approved.

(b) Buildings.—Recommendations for building construction in 1942 were approved as follows :—

1.	Quarters for Chief Budder ...	Rs. 2,500-00
2.	Improvements to Engine Driver's Quarters ...	„ 675-00
3.	Manure Shed at Dartonfield ...	„ 551-00
4.	Workshop at Dartonfield ...	„ 900-00

Estimates for the construction of labourers' cottages were referred back to the Committee for further consideration.

6. Power Supply at Dartonfield

A breakdown of the large engine at Dartonfield was reported and it was decided, after consideration of a proposal to instal a standby engine, to ask the Board's Consulting Engineers to report on future power requirements.

7. Accounts

(a) Statement of Receipts and Payments of the Board for the quarter ended 30th June, 1941, was approved.

(b) Dartonfield and Nivitigalakele Accounts for May, June and July, 1941, were tabled.

(c) Estimates of Income and Expenditure for 1942.—

Draft estimates of income and expenditure for 1942 were considered. After discussion and amendment, estimates were approved according to the following summary :—

Income	...		Rs. 353,884-00
Expenditure —			
Revenue	Rs. 235,723-00		
Capital ...	,, 12,664-00		Rs. 248,387-00

8. Staff

Mr. R. K. S. Murray.—Approval was given for one month's extension of leave on medical grounds.

9. Meetings

In view of the large amount of business to be dealt with, it was decided to hold six Board meetings annually instead of the four meetings laid down as a minimum in the Rubber Research Ordinance.

Consideration of other items on the agenda was postponed and the meeting closed with a vote of thanks to the Chamber of Commerce for the use of the room.

Research Laboratories,
Dartonfield, Agalawatta,
14th November, 1941.

Minutes of the fifty-ninth meeting of the Rubber Research Board held at the Chamber of Commerce, Colombo, at 2-30 p.m. on Monday, 8th December, 1941.

Present.—Mr. E. Rodrigo (in the Chair), Mr. C. E. Jones (Deputy Financial Secretary), Mr. W. P. H. Dias, J.P., Mr. G. E. de Silva, M.S.C., Mr. T. C. A. de Soysa, Mr. F. H. Griffith, M.S.C., Mr. R. J. Hartley, Mr. R. C. Kannangara, M.S.C., Mr. F. A. Obeyesekere and Mr. E. C. Villiers, M.S.C.

Mr. T. E. H. O'Brien, Director, was present by invitation.

Apologies for absence were received from Messrs. J. A. S. Agar, T. Amarasuriya, J. D. Farquharson, E. W. Whitelaw and L. M. M. Dias.

1. Minutes

Draft minutes of the meeting held on 27th October, 1941, which had been circulated to members, were confirmed and signed by the Chairman.

2. Board

The Chairman reported that :—

(a) Mr. E. W. Whitelaw had been renominated by the Rubber Growers' Association to serve on the Board for a further period of three years from 14th December, 1941.

(b) Mr. J. A. S. Agar had been nominated by the Ceylon Estates Proprietary Association to serve on the Board for a period of three years from 6th October, 1941, in place of Mr. J. C. Kelly who had resigned.

3. Smallholdings Committee

Recommendations made at meetings of the Smallholdings Committee held on 12th September and 5th November, 1941 were considered :—

(a) Joint Work with Co-operative Department.—

Agreed that the necessary capital (about Rs. 2,000) should be advanced to enable a Rubber Producers' Co-operative Society to be formed, subject to payment of interest at 2½ per cent per annum after the first year, and repayment of the capital in ten instalments after the first year.

(b) Marketing of Sheet.—

Agreed that the Research Scheme should establish and operate a buying agency for smallholders' rubber in a suitable centre for a trial period of one year, employing a manager on commission.

(c) Coagulants.—

Noted that the Government Marketing Department had arranged to undertake the sale of acetic acid in sealed bottles, and that the statutory maximum prices had been adjusted to provide a reasonable margin of profit for the retail sale of acid in sealed bottles in outstations.

4. Staff

Decided that Mr. C. D. de Fonseka, (Secretary to the Director) be promoted to the post of Secretary-Accountant on the salary scale previously approved for the Estate Superintendent.

5. London Advisory Committee

(a) Minutes of meetings of the London Advisory Committee for Rubber Research (Ceylon and Malaya) and the Technical Sub-Committee held on 6th June, 1941, were tabled.

(b) The following changes in membership of the Committee were reported :—

(1) Mr. F. P. Jepson to represent the Government of Ceylon *vice* Dr. W. Youngman who had resigned.

(2) Mr. H. W. Horner to represent Ceylon Planting interests *vice* the late Sir Herbert Wright.

6. Publications

The following publications were tabled :—

1. Annual Report for 1940.
2. Ist and 2nd Combined *Quarterly Circular* for 1941.
3. Advisory Circular No. 2 (Revised October, 1941).

7. Director's Report

The Director's report for the 3rd quarter 1941 was considered and adopted.

8. Experimental Committee

Recommendations made at a meeting of the Experimental Committee held on 14th November, 1941, were considered.

(a) Power Requirements at Dartonfield.—

The Consulting Engineer's report on power requirements at Dartonfield was adopted, and it was decided to instal a 20-23 h.p. Gardner engine and electric generator. A sum of Rs. 9,000 was voted to cover the cost of purchase and installation, and extension of the engine room.

(b) Labourers' Quarters.—

The recommendation that all labourers' quarters be constructed of permanent materials was adopted. It was decided that a quadruple set of quarters be constructed in cement bricks with tiled roof at Dartonfield, and a similar set at Nivitigalakele. A vote of Rs. 6,000 was approved for the purpose.

(c) Quarters for Junior Employees.—

Approval was given for the construction of one junior staff bungalow at Dartonfield in 1942. The Director was asked to submit plans of a cheaper type of bungalow than those previously erected.

It was also agreed that proposals be formulated for providing living accommodation for all minor employees at Dartonfield.

(d) Test-tapping at Wagolla.—

Decided that test-tapping of budded trees at Wagolla be discontinued after the next resting period, and that the lease of the land be relinquished.

(e) Nederlands Indies Rubber Research Institute.—

Decided to offer the fullest co-operation to the newly-formed Nederlands Indies Rubber Research Institute at Buitenzorg, Java.

9. Accounts

(a) Statement of Receipts and Payments of the Board for the quarter ended 30th September, 1941, was approved.

(b) Dartonfield and Nivitigalakele accounts for August, 1941 were tabled.

(c) Reported that Rs. 15,000 had been invested in Ceylon Government 3 per cent War Loan 1956/60 on November 27th, 1941.

(d) Reported that Rs. 20,000 had been placed on fixed deposit with the Imperial Bank of India for 12 months from 28th November, 1941, at 1½ per cent interest per annum.

The meeting terminated with a vote of thanks to the Chamber of Commerce for the use of the Committee room

Research Laboratories,
Dartonfield, Agalawatta.
23rd December, 1941.

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		Pilmoor B/84	Pilmoor D/65	Pilmoor A/44 or B/58
First	100 yards	Rs. 5/-	Rs. 2/50	Rs. 1/50
Next	100 ,,	,, 3/80	,, 1/90	,, 1/-
Next	300 ,,	,, 3/-	,, 1/50	-/75
Next	500 ,,	,, 2/50	,, 1/25	-/60
Above	1,000 ,,	,, 2/-	,, 1/-	-/50

(Minimum quantity: 3 yards)

Budded Stumps—per stump.

		Pilmoor B/84	Pilmoor D/65	Pilmoor A/44 or B/58
First	100 stumps	-/60	-/30	-/25
Next	100 ,,	-/50	-/25	-/20
Next	300 ,,	-/40	-/20	-/15
Next	500 ,,	-/35	-/15	-/10
Above	1,000 ,,	-/30	-/15	-/10

(Minimum quantity: 20 stumps)

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London Advisory Committee for Rubber Research (Ceylon and Malaya).

Member nominated by the Colonial Advisory Council of Agriculture and Animal Health:

Dr. H. A. Tempany, C.B.E.

Member nominated by the Government of Ceylon:

Mr. F. P. Jepson.

Member nominated by the Governments in British Malaya:

Mr. J. Lornie, C.M.G.

Members representing Malayan Planting interests—nominated by the Rubber Growers' Association:

Mr. P. J. Burgess (Chairman).
Mr. J. L. Milne.
Mr. Eric Macfadyen.

Members representing Ceylon Planting interests—nominated by the Rubber Growers' Association:

Mr. G. H. Masefield.
Mr. George Brown
Mr. H. W. Horner.

Member representing Manufacturing interests:

Lieutenant-Colonel J. Sealy-Clarke.

Ex-Officio Members:

Sir H. A. F. Lindsay, K.C.I.E., C.B.E., Director of the Imperial Institute.
Professor V. H. Blackman, Director of the Botanical Laboratories, Imperial College of Science and Technology.
Dr. S. P. Wiltshire, Director of the Imperial Mycological Institute.
Sir John Russell, O.B.E., Director of the Rothamsted Experimental Station.

Secretary:

Mr. J. A. Nelson, B.Sc.

The Technical Sub-Committee consists of members of the Advisory Committee with the following co-opted Members:

Mr. G. Martin (Superintendent of Rubber Investigations).
Mr. G. E. Coombs.
Mr. G. G. Balazs.
Mr. H. N. Ridley
Dr. Samuel Pickles
Dr. H. P. Stevens
Dr. D. F. Twiss
Prof. R. G. H. Clements

STAFF.

Mr. G. Martin, B.Sc. A.I.C., F.I.R.I.
Mr. H. C. Baker, M.Sc., A.I.C., A.I.R.I.
Mr. W. G. Wren, B.Sc., A.R.C.S.

RUBBER RESEARCH SCHEME (CEYLON)

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The Budding of Rubber. By R. A. Taylor, B.Sc., Physiological Botanist (out of date)

Diseases of Rubber in Ceylon. By R. K. S. Murray, A.R.C.Sc., Mycologist.

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